TECHNICAL SPECIFICATIONS

PORTABLE ELECTRONIC REFERENCE STANDARD METER OF ACCURACY CLASS 0.2S (ACTIVE AND REACTIVE) FOR TESTING OF LT WHOLE CURRENT THREE PHASE METERS AND LT CT OPERATED ENERGY METERS.

1.0 SCOPE

This scope covers the general and standard technical requirements, technical data, design, engineering, manufacturing, assembly, inspection and testing at manufacturer's works, supply and delivery at stores of portable light-weight Electronic Reference Standard meter (RSM) with complete accessories of accuracy class 0.2s for Clamp on CT mode-Primary and Secondary, for the current range of Primary 1A to 400A and Secondary 50mA to Max 10A at site as well as in Laboratory both for active and reactive energy.

A portable, light-weight, electronic, precision portable energy meter testing equipment shall be capable of testing of all types of LT single phase two wire, three phase four wire whole current energy meters and CT operated Energy meters in the range of Clamp on CT Primary 1A to 400A or above and Secondary 50mA to Max 10A at site as well as in Laboratory both for active and reactive energy.

1.1 APPLICATION:

The RSM meter shall be capable of performing the following functions using inbuilt display:

- Suitable to measure the system parameters and verify the accuracy of all types of three-phase, LT CT and single phase energy meters in the laboratory and at site without disconnecting consumers supply when used with the clamp-on CT.
- Verification of meter circuit connections using Phasor diagram
- Selection of measurement mode between total or fundamental mode for four wire active, reactive and apparent power / energy shall be provided.
- Capable of giving the error at both direct mode and clamp on CT mode
- Selection of Apparent power calculation between arithmetic and geometric for total and per phase.
- The RSM shall Show Active, Reactive and Apparent Power Due to each harmonic up to 40st order.
- The RSM meter shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous

commercial operation, in a manner acceptable to BESCOM, who will interpret the meaning of drawings and specification and shall have the power to reject any work or material which, in its judgment is not in accordance therewith.

- The offered equipment shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in these specifications and / or in the commercial order or not.
- The Portable Electronic Reference Standard Meter shall have features to display in vector diagram (for installation check), Harmonics Analysis for selected voltage, current, Power (Active, Reactive & Apparent) from 2nd to 40th harmonics, for analyzing the quality of power. The instrument shall have real time waveform display for selected voltage & current circuits.

1.2 SERVICE CONDITIONS:

The RSM to be supplied against this specification and shall be suitable for satisfactory continuous operation under the following tropical conditions and Environmental Conditions:

S. No.	Parameter	Range
1.	Maximum ambient temperature	50 º C
2.	Minimum ambient temperature	-5 º C
3.	Maximum ambient air temperature in shade	45 º C
4.	Average daily ambient temperature	40 º C
5.	Minimum relative humidity	25 %
6.	Maximum relative humidity	90%

1.3 APPLICABLE STANDARDS:

Unless otherwise specified elsewhere in this specification, the RSM shall confirm in all respects including performance and testing thereof to the following Indian/ International Standards to be read with up to date and latest amendments/ revision thereof:

IEC687	Alternating current static watt-hour meters for Active Energy
IEC736/1982 with latest amendments	Testing equipment for Electrical Energy Meters
IEC62052-11:2003	Electricity metering equipment (AC)-General requirements, test and test conditions-part-11-Metering equipment
IEC61000-4-5	Electromagnetic compatibility, testing and

	measurement techniques, surge immunity test.
IS:9000 with latest amendments	Basic Environmental Testing procedures for Electronic and Electrical items
IEC60687-2000 with latest amendments	AC Static watt-hour meters for active energy, calss-0.2s
IEC62053-21	Electricity Metering equipment (AC)-Particular requirements-part-21 static meters for active energy, class 0.5
IS:11426 with latest amendments	Alternating current precision watt-hour meter of class 0.5 for testing purposes
IS:12346	Testing equipment for AC Electrical Energy Meters
IS:13010/2002	AC watt-hour meters, calss-0.5, 1 and 2
IS:13779/1999	Specification for Energy meter of class 1 and class 2- Specification
IS:14697/1999	AC Static Transformer operated watt-hour and VAR-hour meters, class 0.2S – specification
IS:15707/ 2006	Specification for Testing, evaluation, installation & maintenance of AC Electricity Meters-Code of Practice
IS:15884/ 2010	Connected Static Prepayment Meters for Active Energy (Class 1 and 2) - Code of Practice
IS:15959	Specification for Alternating Current Direct. Data Exchange of Electricity Meters
IS:16444 (Part 1&2)	Specification for Alternating Current Direct Connected Smart Meters for Active Energy (Class 1 and 2) & Class-0.5s /0.2s for CT Operated - Code of Practice

1.4 ACCURACY REQUIREMENT:

- Accuracy class of the RSM shall be 0.2s with Clamp on CT Primary (1A to 400A) and Secondary (50mA to Max 10A) for consumers under all conditions of testing at site/ lab.
- Capable for performing the Accuracy on both Primary and Secondary currents simultaneously in CT operated meters.
- Capable of giving the error at both ends of the connections i.e., Primary and secondary side.
- Capable of verifying the CT Ratio-MF, identifying VT Ratio error, Phase angle difference.

1.5 SUPPLY SYSTEM:

S. N	Particulars	For LT Application	
		Three Phase Meter	Single Phase Meter

o			
1	Supply voltage	3x 240V (+20% & -30%) phase to neutral for three phase four wire	240V (+20% & -20%) Phase to neutral
2	Frequency	50 Hz + 5%	50 Hz + 5%
3	Working range	Clamp on CT Primary (1A to 400A) Clamp on CT Secondary (50mA to Max 10A)	
4	PF Range	0 Lag-Unity-0 lead	

1.6 POWER CONSUMPTION:

The power consumption of the RSM at a reference voltage, frequency, temperature and rated current shall not be more than 2 VA total in voltage circuit excluding the leads.

1.7 CONSTRUCTIONAL AND GENERAL REQUIREMENTS:

- The RSM meter shall be designed and constructed in such a way to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially:
  (a) Personal safety against electric shock- User interface unit should be electrically isolated.
  (b) Personal safety against effects of excessive temperature.
  (c) Protection against penetration of solid objects, dust & water.
- All parts that are likely to develop corrosion under normal working condition shall be effectively protected against corrosion by suitable method to achieve durable results. Any protective coating shall not be liable to damage by ordinary handling nor damage due to exposure to air, under normal working conditions.
- The RSM meter shall have scanner and optical sensor head along with detachable lead to be used to count revolutions of the disc in Ferraris Wheel meters and LED pulses in static meters as well as for LCD pulses in static meters.
- The RSM meter shall be provided with a good quality sensor head clamp to hold the scanner properly in front of the LED / LCD output.
- The RSM meter shall also have a snap switch along with detachable lead to be used as an alternative to scanner/sensor head.
- The RSM meter shall be provided with clamp-on set of CTs which enable the testing without isolating or interrupting the supply of the consumer.

- The voltage leads with injection type crocodile clips / any other suitable clamping arrangement with insulated leads shall be provided on RSM.
- One set of voltage lead with injection type crocodile clips shall be provided
- RSM meter shall have facility to display meter connections verification by Phasor diagram in RYB.
- All the display parameters indicated in clause no. 1.8 shall be obtained by wireless color display. Thin film Transistor or LCD.
- RSM meter must be capable to measure Primary and Secondary currents for all 4 CTs simultaneously.
- The ERS meter shall have a facility to store minimum 10000 test results along with following instantaneous parameters. The ERS meter shall have memory to record the test data. The error data not less than 10000 test shall be stored in RSM memory
    1) The Test data shall be stored on FIFO basis and these can be downloaded to computer using USB/RS232 cable to print test results from software and option to print latest test result through portable printer at site.
    2) BCS shall be provided by the supplier along with the instrument.
- The test data stored in the memory of RSM shall not be lost by roll over mode but after the memory is exhausted it should flash a message on TFT display or it should have alternate arrangement for such indication.

The following data shall be incorporated in BCS after completing each calibration at site as well as lab, which are as follows:

a. Serial Number of Meter under test (MUT)
b. RR Number
c. Consumer Name and Identification number.
d. Meter Constant of MUT / CT Ratio.
e. No. of revolution / pulses for which test is being carried out.
f. Instantaneous voltage, line current, active current & reactive current power factor of each phase, and frequency.
g. Energy Logged/ Recorded by RSM during test.
h. Test duration in hour, minute, & seconds (With time of commencement & completion) and all parameters shown in Clause no.1.8.
i. Percentage error
j. Print of latest test results at site

- Apart from the meter testing information BCS should have the facility to store other consumer information's after

testing, which is the routine of BESCOM MT division. Output format should be in BESCOM field report format either in Kannada or English language or both. Inputs are listed below:

Single phase meter
a. Reference
b. SPRS Testing fess if yes
c. RT No. and date
d. Check readings
e. Meter Main Cover serial No
f. Terminal cover Sl.no
g. Results

Three phase meter	
General Inputs	Name, Address, type of installation, captive generator set, Tariff, reason for testing, last rating date, Rated load, Sanctioned load
Meter reading and conditions	Date/time, check reading, average PF, demand, bill reading, reset count, each phase current, each phase potential, each phase PF
Existing CT details	Make, CT ratio, class, VA, CT serial No
Existing Meter details	Make, serial No, Imp/KWH, in case of replacement-reason with load details
Sealing details	Main cover, terminal cover, CT cover, meter chamber, Optical port, Bus bar chamber, Change over switch

- The RSM meter shall be capable of indicating the display for the following conditions by instantaneous values, warning message and beep alarm:
  - ⇨ Missing Potential any of R,Y,B
  - ⇨ Missing current any of R,Y,B
  - ⇨ Reverse current, if any current is reverse.
  - ⇨ Phase sequence, if forward or reverse. (for both voltage and current sequence)
  - ⇨ Over current (for current more than 120%)
  - ⇨ Over Voltage (for voltage more than 130%)
  - ⇨ Low Voltage (for voltage less than 70%)
  - ⇨ Wrong association of voltage and current

- The RSM meter shall have a test output in the form of frequency on BNC/LED pulse output for its own calibration. (General arrangement drawing of Equipment shall be submitted along with bid which indicates the above mentioned outputs). For its calibration with reference to the other standard reference meter with any NABL accredited/any internationally recognized lab, the RSM shall not require any other interface links, like cable, etc. If required the same shall be provided by the supplier along with RSM.
- The unit shall be powered up through an adapter which can get supply either from the measuring circuit or from auxiliary single phase supply. However, the RSM meter shall be made functional by giving supply of 240 Volts +-30% AC through an adapter between phase to neutral for downloading the data to PC, laptop etc., through wired/ wireless communication like Bluetooth, Wi-fi etc.,
- The RSM meter shall measure and display the three phase system showing instantaneous values of Voltage and Current for comprehensive analysis in the site.
- Auto range of Current and Voltage inputs shall be provided.
- The RSM meter shall display the error(s) of the meter under test automatically.
- The RSM meter shall have wireless interface display connected via Bluetooth for Meter Testing and Comprehensive field analysis like Wiring Verification, Harmonic analysis and to fetch the data to the BCS.
- The RSM meter shall be manufactured as per latest state of the art technology for obtaining sustained accuracy, flawless long lasting service. It shall be rugged enough to undergo handling in field conditions while being carried from place to place.
- There shall be a provision for input of scan head and start/ stop option on the Display.
- The RSM meter shall be of low weight, compact and of small size with suitable vibration protected carrying case.
- The RSM meter shall be type tested for IP 40 degree of protection as per IS: 12063 against ingress of dust & moisture.
- Auto measuring range shall be provided & switching between ranges should not affect the measurement.
- RSM meter shall have capability to indicate display for the following conditions:
  - Reverse current if any current is reverse.
  - Wrong/correct association

of voltage & current.

- The RSM meter shall measure and display a comprehensive analysis of three phase system showing instantaneous and integrated values of
  - True RMS value for each phase voltage
  - Analysis of Harmonics contents
- Phasor display of system parameters.
- Wave form display of voltage & current.
- Harmonic content - Phase wise harmonics of voltage and Current with THD. Harmonics displayed as bar graph and also values up to 31st harmonics (higher harmonics analysis will also be accepted, without affecting the price).
- The RSM meter shall be capable of testing kWh, kVarh, Kvah register of Energy Meter and displaying the % error as well as energy logged/recorded by RSM meter automatically.
- An error calculator shall be incorporated in the Electronic Reference Standard Meter which shall have facility to calculate error in percentage of Meter under Test, by feeding the meter constant and number of pulses for which meter was tested with Electronic Reference Standard Meter.
- The meter shall be packed in an ergonomically and aesthetically designed instrument case which can withstand the usual handling of field personnel and normal transportation.
- Dial test facility must be available by using optical port available in the meter of DLMS protocol.
- The real time quartz clock shall be used in the RSM meter for maintaining time (IST) and calendar. The RTC shall be non-rechargeable and shall be pre-programmed for 30 years calendar of date and time without any necessity for correction. The RTC shall have Non rechargeable battery with long life (10 Years).
- The RSM shall have the facility to record and store minimum 10000 test results along with various instantaneous parameters. The life of NVM shall be minimum 10 years. The data up to at least 10000 tests shall be stored in the device and give flashing alarm when 90% of memory is used and these can be downloaded to computer using communication cord USB/RS232 port. The test data stored in the memory of the RSM meter shall not be lost by roll over mode; but after the memory is exhausted, it shall flash the message on the display or it shall have some other arrangement for such indication.
- USB/RS232 communication ports shall be provided to download the data to the computer for printing the test

results.

- The equipment's Display interface shall have facility to view / monitor system Parameters during performing the Error testing, Dial testing without interrupting the On-going testing in the field.

1.8 DISPLAY:

The accucheck should have wireless display. Wireless display of the RSM shall be of color touch screen with high resolution and suitable screen with device protection. Screen shall have size of 8'' or above to view all the relevant parameters in one screen. The RSM shall show the following instantaneous parameters on initial screen.

Sl. No	Instantaneous Parameters
1.00	Real Time & Date (DD:MM:YYYY, HH:MM)
2.00	R phase Voltage Phase Neutral (VR) & Phase to Phase (VRY)
3.00	Y phase Voltage Phase Neutral (VY) & Phase to Phase (VYB)
4.00	B phase Voltage Phase Neutral (VB) & Phase to Phase (VBR)
5.00	Line current R phase (Ir) with directions (+ or -)
6.00	Line current Y phase (Iy) with directions (+ or -)
7.00	Line current B phase (Ib) with directions (+ or -)
8.00	Frequency
9.00	Three phase Active power (Total)
10.00	Three phase Reactive power (Total)
11.00	Three phase Apparent power (Total)
12.00	Active power R phase
13.00	Active power Y phase
14.00	Active power B phase
15.00	Reactive power R phase
16.00	Reactive power Y phase
17.00	Reactive power B phase
18.00	Apparent power R phase
19.00	Apparent power Y phase
20.00	Apparent power B phase
21.00	Three phase average Power Factor
22.00	Power factor R phase
23.00	Power factor Y phase
24.00	Power factor B phase

25.00	Phase Sequence (Both current & Voltage Sequence)
26.00	MUT & System Error (Combined Error)
27.00	Calibration date of Equipment and calibration due date
28.00	RYB phase - Voltage and current up to 51st Harmonics
29.00	Vector diagram for Voltage, Current, Power

1.9 DISPLAY RESOLUTION:

The Minimum Resolution for various parameters shall be as follows:

(1)	Voltage with resolution	000.00 V
(2)	Current with resolution	000.000 A
(3)	Power Factor with resolution	0.000
(4)	Energy Measurement with resolution of(WH/VARH/VAH)	000.0000 (Min)
(5)	Frequency Measurement with resolution	00.00 Hz
(6)	Indication of utilization of the memory	00.0 %
(7)	Instantaneous load (kW/ kVAr/ kVA)	00.000
(8)	Percentage error	00.00 %

- RSM shall be able to test the meter under test by entering the MUT constant, number of test revolutions. The meter constant of MUT may also be imp / kWh. The device shall provide flexibility to enter meter constant up to 7 digits.
- The testing of MUT shall be performed by using common scanning head, suitable for sensing of rotor mark of Electro Mechanical meters or LED / LCD blinking of electronic meters. The scanning head shall be supplied along with mounting arrangement and connection cable.
- The ERS shall allow using start / stop option integrated on touch display to start and stop the meter test.

1.10 TESTING:

The bidder shall provide at his cost, facilities to carry out the tests at the time of inspection of these equipment at the manufacturer premises as per sampling plan of relevant IS.

1.11 OPERATING MODES:

The equipment shall have a name plate clearly visible, effectively secured against removal and indelibly and distinctly marked with all essential particulars as per relevant standards.

MANUAL MODE: The equipment shall have facility to test in manual mode using snap switch along with detachable lead as well as inbuilt menu to start and stop the test.

AUTO MODE: A scanner shall be provided along with the equipment to test electro mechanical meters by sensing the rotor mark and static (electronic) meters by sensing the LED / LCD pulses. The scanner shall be provided with clamp type fixing arrangement or any other arrangement suitable to test the meter in laboratory as well as at site.

The equipment shall have facility to select measuring mode between fundamental or total power/ energy for three phase four wire active, reactive and apparent measurements.

1.12 NAME PLATE DATA AND MARKING:

The equipment shall have a name plate clearly visible, effectively secured against removal and indelibly and distinctly marked with all essential particulars as per relevant standards. Sl. No. of the equipment along with date of manufacturing as well as other technical details shall invariably be mentioned on the equipment as well as on the

Hand bag / carrying case. Serial number shall be marked on the equipment as well as on the carry case. In addition, following shall be marked on the equipment and carry bag.

- Manufacturer's name.
- Designation of type.
- Serial number.
- Current range
- Reference voltage
- Accuracy Class
- Property of "BESCOM"
- Purchase order no. & date
- Guarantee Period
- Reference frequency.
- Month & Year of manufacture

1.13 TYPE TESTS REQUIRED AS PER STANDARDS:

- Insulation test
- Test of Limits of errors
- Test of meter constant
- No-load test
- starting current
- Repeatability of error test.
- Test of power consumption.
- Test of influence quantities
- Test of accuracy requirements
- Test of operation of scanner

1.14 TYPE TESTS:

1) Insulation test
2) Limits of errors test
3) Test of meter constant
4) No-load test
5) starting current
6) Repeatability of error test.
7) Test of operation of Snap switch
8) Verification of RSM, data storage and retrieval through BCS
9) Test of operation of scan head.
10) Test of power consumption.

1.15 ACCEPTANCE & ROUTINE TEST CERTIFICATES:

All acceptance tests shall be carried out on the equipment during the inspection. All routine test certificate, calibration certificate & operation manual must be provided along with

each equipment in the form of CD (Compact Disc) as well as a hard copy.

1.16 CALIBRATION CERTIFICATES OF RSM:

The RSM shall be supplied along with the calibration certificate as per relevant standards. The calibration certificate shall be issued by NABL accredited/any internationally recognized labs on expiry of validity, 1st year calibration certificate shall be renewed (calibrated) by the supplier for further one year.

1.17 ACCESSORIES:

Each RSM reference meter shall be supplied along with the following accessories:

- One common/ separate optical sensor for automatic testing, which can be used to sense disc revolutions in electromechanical meter as well as indicating LED/ LCD in static meter including clamp on device and connection cable 3Mtr. Long and scanning head carriage.
- Wireless Tab/ Handy laptop/ In built display (if provided) should be of TFT Display with Bluetooth device.
- Mounting arrangement (clamp) for the optical sensor.
- A set of voltage leads with insulated clips.
- Power ON cable and Serial communication cord with USB/RS232 connector to retrieve stored data from the Equipment and download the same on PC / laptop.
- Snap switch along with detachable lead as well as in built snap switch.
- Operating Manual in English
- One Mains cable as per IS standard
- One standard calibration report
- Base Computer Software
- Two set of Clamp On current transformers (CT) of 400A and 10A confirming to class 0.2S complete with connection cable for on-line testing.
- Optical probe for DLMS Dial test
- Crocodile type PT clips should have been provided for ease of use to connect with incoming fuse points.
- Portable printer with charger and communication cable for printing latest test result at site.
- ID of clamp CT- Primary- 50 mm, Secondary-8mm.

1.18 TRAINING:

The successful bidder shall depute their representative to educate Engineers of purchaser as and when they will be called for at no extra cost.

1.19 GUARANTEE:

The RSM unit shall be guaranteed for a period of 66 months from the date of receipt in stores.

In case of any RSM found defective within the guarantee period the same shall be replaced / repaired / rectified by the supplier at free of cost, within one month of receipt of intimation for repair and rectification or replacement.

The bidder should provide a standby RSM till the faulty RSM get repaired and returned. After the replacement / repairs / rectification, the accuracy shall not be affected. Test report and calibration certificate shall invariably be submitted after rectification / repairs. If defective RSM is not replaced/ repaired / rectified within the specified period as above, the Company shall recover an equivalent amount.

1.20 AFTER SALES SERVICE:

The bidder has to indicate clearly the after sales service to be provided by the supplier within guarantee period and outside guarantee period and Addresses of Sales Service Centre, details of Engineers, etc. shall be submitted along with the offer.

1.21 DOCUMENTATION:

Two sets of following documents shall be supplied along with each test System.

- Operating manual
- Service manual
- Calibration certificate of reference standard meter.

1.22 WIRELESS TAB/ HANDY LAPTOP DISPLAY DEVICE AND PRINTER SPECIFICATIONS:

WIRELESS TAB/ HANDY LAPTOP DISPLAY DEVICE:		
(1)	Operating System	Latest Android/ Windows and subject to up gradation at the cost of the agency till guarantee period
(2)	Bluetooth	V4.0 subject to up gradation
(3)	Memory	RAM- 8GB, ROM-128GB
(4)	Battery	5000 mAh
(5)	Display size	Minimum 8 inch
(6)	Camera	Yes

(7)	SIM	Yes (Optional)
(8)	Wifi	Yes
PRINTER:		
(1)	Design	Portable and easy to handle
(2)	Mode of operation	Battery
(3)	Print capacity	50 reports with full charge
(4)	Width	3’’
(5)	Printing paper size	Universal and provided with printer
(6)	Communication facility	USB/ RS-232/Bluetooth/Wifi
(7)	Language	English
(8)	Battery	Rechargeable